EUROPEAN FOREST PRACTICES OF INTEREST TO AMERICAN FORESTERS

Alexander

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

ADDRESS REPLY TO
CHIEF, FOREST SERVICE
AND REFER TO

WASHINGTON 25, D. C.

R
SUPERVISION
Meetings

June 22, 1954

Directors:
All Stations including AL and TR

Dear Sir:

Last fall Leo Isaac, Pacific Northwest Station, made a trip to Germany to attend a conference, following which he toured western Europe. He made it a point to see as much of the work in forest tree improvement as possible and has written up the highlights of his observations. In view of our expanding program of research in tree improvement, I thought you would be interested in his impressions. His brief summary has been multilithed and copies are attached.

Very truly yours,

F. H. EYRE, Chief
Division of Forest Management Research

Attachment

EUROPEAN FOREST PRACTICES OF INTEREST TO AMERICAN FORESTERS

By

Leo A. Isaac, Forester
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It was my privilege to attend, as a consultant on tree seed, the "European Congress on Productivity in the Forestry and Timber Industries," held at Stuttgart, Germany, in September 1953. Following the meeting I spent three weeks in west Germany, paying particular attention to areas where studies in genetics and regeneration were under way and to plantations where difficulty was being experienced with the introduction of American species. Later I spent five weeks visiting the Scandanavian countries, southern European countries, and the British Isles, observing studies in regeneration, stand improvement, genetics, and particularly noting the establishment of seed orchards.

Discussion during the Congress emphasized that forest production could be increased by (1) conversion from broadleaf to coniferous trees, (2) use of better or improved strains of local species, and (3) careful introduction of foreign species more productive than their own. Some of the observations made on the trip may be of interest to American foresters.

NATURAL SELECTION AND CROSS BREEDING FOR SPECIES IMPROVEMENT

Identification of Superior Stands of European Species

Through trials and costly mistakes, European foresters have learned to identify and use the superior stands of their important timber species for seed production.

In Germany it is required by law that stands must be certified for seed collection and seed sale. Rules in the other countries may not be so strict, but approved strains are demanded for most artificial reforestation, and foresters classify their own stands very carefully for seed collection. Near Hann.-Münden, Dr. Strehlke showed me an excellent stand of Norway spruce preserved for seed production. It was one of the few indigenous stands that I saw south of Sweden and Norway. South of Helsingborg, Sweden, Count Rosenon showed us excellent stands of Norway spruce on his estate from which all of his seed was obtained. The same was true for most other foresters visited, they all seemed to have a lively concern that seed came from good stands and the right olimatic zone. Their interest is illustrated by the attached photographs showing forests from good and from poor seed. It was published in a propaganda leaflet, "Du Und Der Wald" (You and the Forest), in October 1952.

Development of Improved Strains From Natural Stands

A condition develops in European forest practice that results in species improvement by natural selection that might well be given attention by

Tree from a poor limby strain of Scotch pine (left) occupies as much space as 3 trees from a good timber strain (right) of the same species.

American foresters. They start with the best strain available, grow it in dense even-aged stands, and start to thin at an early age. In the thinning process, practically all slow growing, badly formed, or otherwise undesirable pollen parents are removed before a stand reaches an effective seed-bearing age for natural regeneration or seed collection. The longer such stands are held, the more complete can be the elimination of inferior trees. I was shown seed collection areas of Scotch pine and Norway spruce, and also beech and birch where every tree in the stand was a straight, clean boled specimen. I also saw stands where the good trees had been removed and the poor trees kept in thinning, and they were a sorry sight in comparison. It was my impression that most seed now collected in Europe comes from stands where the inferior trees have been removed by thinning.

"Plus Trees" and "Seed Orchards"

The most active phase of the species improvement program in Europe is the selection of so-called "plus trees" and the development of "seed orchards" from them. Ten or more plus trees are usually selected for a locality. The actual number varies among both countries and individual investigators. Cuttings from these trees are grafted on hardy local stock, and when well developed, they are set out in isolated patches or blocks for seed production. These patches are called "seed orchards". Denmark and Sweden (and perhaps other countries) have developed a system for registering superior or "plus" trees, and the Swedish Forest Institute has developed "plus tree archives" where plus tree cuttings are grafted onto local stock to preserve the stock of the original parent (that may be cut or destroyed) and have it readily available for current use. "Elite tree" is the term

used in Sweden for the superior trees. Dr. C. Syrach Larsen, near Copenhagen, perhaps one of the earliest scientists in the field, works in cooperation with the Danish Forest Service and has extensive gardens for the development of grafted stock and many established tree orchards. Mr. Holger Jensen, near Helsingborg in south Sweden, working in cooperation with Bertil Lindquist of the Gothenburg Botanic Garden, has developed the stock and established "seed orchards" at his own expense and on his own valuable land. He now has such seed orchards for the important species of western Europe; and those of ash, birch, and beech are already producing seed.

The selection of the "plus" (or elite) tree depends, of course, on the purpose for which stock is being produced; and at the age when seed production starts, selection is a difficult, and, as yet, not a completely solved problem. Usually the plus tree must have several characteristics such as resistance to disease and insect attack, climatic hardiness, rapid growth rate, clean bole, good wood quality and certain crown characteristics.

Guides for the selection of plus trees of western European young conifers were, for the most part, relative. A general summary of them would be about as follows:

From the standpoint of growth rate, probably not more than one in a thousand trees in a stand would qualify. The crown should have high vigor in the upper third and low vigor from there downward. The crown should be thrifty, but not overly dense or limby. Limbs in the upper third of the crown should not make a sharper angle with the stem than 60°--the more nearly horizontal the better. The crown should not continue to grow wedge

shaped, the upper third should remain pointed and from there down the sides should be vertical.

These guides should be suitable for Douglas-fir and may be usable in part for other North American species.

When resistance to insect attack or disease is important in plus tree selection, this characteristic is looked for first. Other desirable characteristics in association with resistance are then sought for and good characteristics frequently go together.

If an isolated location cannot be found for these seed orchards, they are often surrounded by trees of another species to prevent pollination from an outside source.

Cross Breeding for Hybrid Vigor and the Desirable Characteristics of Both Parent Trees

Along with the program of natural selection for an improved seed source for immediate use, and the development of seed orchards for further improved seed sources in the near future, there is under way in all countries of Europe a program of cross breeding for the further improvement of tree species. The results of cross breeding come more slowly than from selection, but they are often more spectacular. A hybrid of European and Japanese larch (Larix eurolepis) now quite widely used, has both the good growth quality of the Japanese larch and the hardiness of the European. At the Grafrath Experimental Garden near Munich, I was shown a natural hybrid between Japanese and European larch that had beautiful form and was making more rapid growth than any other tree in the place. Work with poplars and many other species is under way in several countries, but the results are too numerous to cover in this brief report.

PROVENANCE TESTS OF INTEREST TO THE DOUGLAS-FIR REGION

Tests of seed from many different species and sources are under way in Europe; but those of particular significance, both over there and in the United States are the tests of Douglas-fir.

One very outstanding study plantation was shown me by Dr. Rohmeder near Munich, Germany. It was one of 23 plantations started in the Bavarian forests by Dr. Fabricius about 1929. Seed was obtained from a cross section of the west slope of the Cascade Range at 5 points that vary in elevation from 300 to 5,000 feet in west-central Washington. In addition, one sample was obtained from the Siskiyou Mountains of southern Oregon and one from Mexico. Twelve of the 23 plantations are still under observation. The record of the Munich plantation is as follows:

Height and diameter of Douglas-fir in a 23-year-old provenance test at Grafrath near Munich, Germany in comparison with yield table data for Norway spruce

Origin		Average height	Average diameter
West-central Washington elevation	Frost-free days		
Feet		Feet	Inches
Under 300	Over 270	18.04	1.93
300 to 1,000	180 to 270	26.24	3.82
1,000 to 2,000	150 to 180	18.37	2.09
2,000 to 3,000	110 to 150	19.35	3.03
3,000 to 5,000	60 to 110	20.99	3.03
Southern Oregon Over 5,000	Less than 60	21.64	2.60
Mexico	?	19.68	2.84
Norway spruce (Lorey Site I)		23.29	2.84

The plantations in Bavaria are mostly at the middle elevations (between 1,000 and 2,000 feet). With one exception (where exact source is in doubt) the seed collected in west-central Washington at elevation from 300 to 1,000 ft.

produced far superior results in both height and diameter growth on these Bavarian plantations. This stock is also more free from the various needle diseases which provides fairly conclusive evidence that it is better suited climatically to the Bavarian planting areas than the other seed sources. The superior growth rate is further proof of suitability, but this may in part be the result of a superior natural strain in Washington. The difference in general appearance of these plantations when I saw them in September 1953 was even more striking than the differences in measurements shown. The 300- to 1,000-foot stock had luxuriant crown growth retaining needles from 3 to 4 years and showed practically no sign of needle disease. Others were affected in varying degrees and some lots appeared to be nearly dead.

The study already presents positive evidence of variation in suitability that exists between seed from different sources and gives a measure of the influence of altitude and climate.

Similar results were found in an earlier study (1910) made by Dr. Munch at Kaisers-Lautern, Germany. In this instance a strain of seed (Snoqualmie), from near Granite Falls in northwest Washington, proved superior to all others. In this plantation, the trees from some strains of seed are practically dead.

As a demonstration, Dr. C. Syrach Larsen in Denmark grafted tips of the blue Douglas-fir from the Rocky Mountains on 5-foot seedlings of the green Douglas-fir from west of the Cascade Mountains in Washington. This was about ten years ago. When I saw the trees in his arboretum last fall, the bottom half of the trees bore a lush growth of heavy green foliage with no

sign of needle diseases, while the tops bore a light complement of sickly blue-gray foliage heavily infected with needle diseases. Some of the tips actually appeared to be dying. The study presents a striking demonstration of two strains of the same species, one of which was not suited to the environment.

In many other parts of Europe, I found either planned studies or paired examples of good or bad strains. In some instances it was a matter of slow and fast growth, in others excessive branch growth and clear boles, and still in other instances it was relative susceptibility to disease or climate.

Records obtained from these European projects provide needed information that would require years of time and an untold amount of work and funds if it had to be derived from new plantations here at home.

FOREST NURSERY AND FOREST PLANTING

Foresters in southern European countries strive for natural regeneration, but if it does not come promptly, they plant. They often underplant following a light shelterwood or seed tree cutting. In Norway and Sweden, the trend is toward more natural regeneration, but they too do a lot of planting.

Size of Nurseries and Planting Stock Produced

At Halstenbek, Germany, I visited a private forest nursery, (Pein and Pein) that was producing 300 million trees a year. I understood that he contracted for an equal number from private growers. His total production about equals the entire forest planting program of the United States. Other nurseries in Germany and other European countries were growing from

a million to 100 million trees a year. These figures give an estimate of the planting program in these war-torn, impoverished countries in comparison with our own.

As rapidly as suitable seed can be secured, they are introducing Douglas-fir and other American species, but the bulk of their planting stock is still Scotch pine, Norway spruce, larch, beech, and birch. Often a forester has a small nursery for his own use. He may raise his own seedling stock or just transplants.

Much of the nursery work is done by women--hand work is the rule, they use very little machinery.

Field planting stock is usually 1-3 or 2-2 (four-year-old). It is approximately twice as large and rugged as the forest planting stock used here in the Northwest.

Western hemlock seedlings are raised with difficulty here in western United States, but they are raising this species successfully in the nurseries of Europe. High organic content of the soil and shade during the first two years were the most apparent reasons for success. At Halstenbek and Munster well rotted barnyard manure was liberally used in the seedbeds, but at Schmalenbeck, where I saw the most luxuriant beds of hemlock seedlings, truckloads of needles and duff had been transported from under dense spruce stands and rototilled into the seedbed soil.

Seedlings were usually sent directly from the nursery to the field. I saw no instance where cold storage was being used to hold seedlings until a planting site was ready.

Establishment of Forest Plantations

A common spacing in plantations has been about 4 feet (a meter-and-a-quarter). This resulted in slow growth and a dense stand from which many trees dropped out before they were a usable size. With rising costs, many are now finding 5- and 6-foot spacing more profitable and also more productive.

Europeans not only use bigger stock and plant more carefully, but they take far better care of the plantations after they are set out. In England and on the continent, it is not uncommon to see land prepared in advance of planting, and weeding or release from competition for several years thereafter. Except in spots, brush does not seem to be a serious problem in European forests, grass is looked upon as the worst competition for natural or artificial regeneration. In Holland, the sod is turned over in the fall and planting is done in the spring after the sod had rotted.

Nowhere did I see grazing in the forest to the extent that it was damaging seedling crops, except from wild game. Wild boars were so plentiful in some parts of Germany that they were eating and rooting the young growth. Deer everywhere were doing damage to plantations by rubbing small trees with their horns. Browsing by deer and rabbits in very young stands was also a very common cause of loss. Many kinds of repellents, spun glass, wire, sheet metal spirals, and many other devices were used to protect planted trees, but none were found altogether successful. When losses were excessive, the forester usually resorted to fencing or replanting.

CUTTING PRACTICE IN EUROPEAN FORESTS

Cutting practice in Europe varied with localities, with tree species, and with the purpose for which the forest was being maintained.

Selection Cutting

During my entire trip over western Europe, I was shown very little individual tree selection cutting where tolerant trees reproduce as the mature trees are cut. I saw none with conifers where the stand was being managed solely for timber production. Forests of beech, birch, European white fir, and sometimes Norway spruce were managed pure or in mixture as an uneven-aged forest, particularly where they had a recreational or watershed value. In my observation, such forests were the exception, not the rule.

Even-Aged Forest Practice

The most common forest practice shown me in Europe was as follows: Start with dense, even-aged stands, begin thinning early (15 years), and continue with light frequent thinnings until a rotation age is reached. Then, a heavy cut is made leaving a light shelterwood or heavy seed tree stand. If natural regeneration does not take place promptly, the area is planted. As soon as the understory is established, the overwood is removed. Sometimes areas are clear cut in small patches and planted.

In general, the thinning in the forest did not appear to follow closely any of the well defined systems described in the textbooks. For coniferous forests, the practice may be summarized as follows: Thinning starts with the removal of dead and dying material, then the thinning moves upward

through the crown classes. "Wolf" and other badly formed trees are taken out when encountered. From that point on to rotation age, the cutting aims to give gradual and frequent release to the best trees in the stand. Although they start with a dense stand, thinning begins early and soon brings the number of trees per acre down below the numbers shown in our normal stand tables. Thinning may be continuous in a stand or may be repeated at 3- to 5-year intervals, but the individual tree is seldom released on more than one side at a time or more frequently than once in 5 years.

If thinning is done gradually over a period of years, Douglas-fir does not appear to be sensitive to small differences in percent of removal. In the Harz Mountains Dr. Strehlke showed me a thinning that was considered about average for the locality. Beside it was a heavier and a lighter thinning. He stated that sample plots in all three areas showed little or no difference in growth rate.

The foregoing pages cover the highlights of a rather fast trip through 10 countries. There were many complications and difficulties associated with language differences and travel, therefore, if I have misinterpreted or misstated any of the things that I saw, I would be pleased to have them called to my attention.

For many of the items mentioned, I have the detailed records; these, when properly translated and analyzed will form valuable additions to our knowledge of forest management.